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विद्युत तकनीकी शब्दावली

भाग 44 दाबविद्युत युक्तियाँ

(पहला पुनरीक्षण)

Indian Standard

ELECTROTECHNICAL VOCABULARY

PART 44 PIEZOELECTRIC DEVICES

(First Revision)

[IEC TITLE — INTERNATIONAL ELECTROTECHNICAL VOCABULARY — CHAPTER 561 : PIEZOELECTRIC DEVICES FOR FREQUENCY CONTROL AND SELECTION]

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NATIONAL FOREWORD

This Indian Standard (Part 44) (First Revision) which is identical with IEC 60050-561 (1991) 'International electrotechnical vocabulary — Chapter 561: Piezoelectric devices for frequency control and selection' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of Piezoelectric Devices for Frequency Control and Selection Sectional Committee and approval of the Electronics and Telecommunication Division Council.

The revision of this standard has been taken up to include the latest terms and their definitions relating to piezoelectric devices used for frequency control and selection.

The text of the IEC Standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

Only the English language text of the International Standard has been retained while adopting it in this Indian Standard.

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Indian Standard
ELECTROTECHNICAL VOCUABULARY
PART 44 PIEZOELECTRIC DEVICES
(First Revision)

CHAPTER 561 : PIEZOELECTRIC DEVICES FOR FREQUENCY CONTROL AND SELECTION

SECTION 561-01 – PIEZOELECTRIC VIBRATORS FOR FREQUENCY CONTROL AND SELECTION

561-01-01 cut (of a piezoelectric crystal element)

The orientation of the edges and/or faces of a crystal element with respect to the crystallographic axes of the single piezoelectric crystal from which it is cut.

561-01-02 piezoelectric crystal element

An element cut from a single piezoelectric crystal, with a given geometric shape, size and orientation.

561-01-03 piezoelectric ceramic element

An element of piezoelectric ceramic material made to a given geometric shape, size and orientation with respect to the polarizing axis.

561-01-04 electrode (of a piezoelectric crystal element)

An electrically conducting plate in proximity to, or film in contact with a piezoelectric crystal element, which enables an electric field to be applied to the crystal element.

561-01-05 electrode (of a piezoelectric ceramic element)

An electrically conducting film in contact with a piezoelectric ceramic element by means of which a polarizing or a driving field is applied to the said element.

Note. — Commonly used electrodes are:

a) fired,
b) plated,
c) vacuum evaporated,
d) sputtered.

561-01-06 piezoelectric crystal or ceramic vibrator

A piezoelectric crystal or ceramic element, with electrodes, which can be made to vibrate in a specific mode.

Note. — Leads may be attached to the electrodes.

561-01-07 monolithic bipole vibrator

Piezoelectric vibrator with two mechanically coupled vibrating regions on a single piezoelectric crystal element or a piezoelectric ceramic element.

561-01-08 monolithic multiple pole vibrator

Piezoelectric vibrator with more than two mechanically coupled vibrating regions on a single piezoelectric crystal element or a piezoelectric ceramic element.

561-01-09 piezoelectric resonator

A unit comprising a piezoelectric crystal vibrator or a piezoelectric ceramic vibrator in its enclosure.

561-01-10 multiple piezoelectric resonator

A unit comprising two or more piezoelectric crystal vibrators or piezoelectric ceramic vibrators in a single enclosure.

561-01-11 mounting system (of a piezoelectric vibrator)

The means by which the piezoelectric vibrator is supported in its enclosure.

561-01-12 enclosure (of a piezoelectric vibrator)

An enclosure protecting one or more piezoelectric vibrators and their mounting system.

SECTION 561-02-CHARACTERISTICS OF PIEZOELECTRIC RESONATORS

561-02-01 mode of vibration

The pattern of motion in a vibrating body resulting from stresses applied to the body, the frequency of oscillation and the existing boundary conditions.

Note. — The most commonly used modes of vibration are:

1) for crystal vibrators
— flexural
— twist
— extensional
— face shear
— thickness shear

2) for ceramic vibrators
— radial (expander)
— thickness shear.

561-02-02 fundamental frequency

The lowest frequency of a given mode of vibration.

561-02-03 overtone frequency

A higher order of frequency than the fundamental of given mode of vibration.

561-02-04 overtone order

The integral numbers given to the successive overtones of a given mode of vibration, in order of increasing frequency commencing with the fundamental as unity.

Note. — For shear and extension modes, the overtone order is the quotient of the frequency of the overtone by the fundamental frequency rounded to the nearest whole number.

561-02-05 unstiffened mode (of piezoelectric vibration)

A mode of vibration, in which, in the ideal unstiffened mode, the electric field is perpendicular to the direction of elastic wave motion and has no influence on the pattern of motion.

561-02-06 stiffened mode (of piezoelectric vibration)

A mode of vibration in which, in the ideal stiffened mode, the electric field is parallel to the direction of elastic wave motion and influences the pattern of motion through electrical boundary conditions.

561-02-07 equivalent circuit (of a piezoelectric resonator)

The electrical circuit which has the same impedance as a piezoelectric resonator in the immediate neighborhood of resonance.

Note. — It consists of series elements L_1, C_1, R_1 in parallel with C_0 where L_1, C_1, R_1 represent the motional inductance, capacitance and resistance respectively and C_0, the shunt capacitance.

561-02-08 resonance frequency (symb. : f_r)

The lower of the two frequencies of a piezoelectric resonator vibrating alone under specified conditions, at which the electrical impedance of the resonator is resistive.

561-02-09 series resonance frequency (symb. : f_s)

The frequency defined by the formula

$$f_s = \frac{1}{2\pi \sqrt{L_1 C_1}}$$

where L_1 and C_1 represent the motional inductance and capacitance respectively.

561-02-10 anti-resonance frequency (symb. : f_a)

The higher of the two frequencies of a piezoelectric resonator vibrating alone under specified conditions, at which the electrical impedance of the resonator is resistive.

561-02-11 parallel resonance frequency (symb. : f_p)

The frequency where the admittance value of a lossless resonator becomes zero.

Note. — When the electromechanical coupling factor is low, an approximate value of this frequency is given by the expression :

$$f_p = \frac{1}{2\pi \sqrt{L_1 \dfrac{C_1 C_0}{C_1 + C_0}}}$$

Where C_0 represents the shunt capacitance and L_1 and C_1 the motional inductance and capacitance respectively.

561-02-12 load resonance frequency (symb. : f_L)

One of the two frequencies of a piezoelectric resonator in association with a series or with a parallel load capacitance under specified conditions, at which the electrical impedance of the combination is resistive.

561-02-13 nominal frequency (of a piezoelectric resonator)

The frequency used to identify the piezoelectric resonator.

561-02-14 working frequency (symb. : f_w)

The frequency of vibration of a piezoelectric resonator with its associated circuits in the intended state of resonance.

561-02-15 overall frequency tolerance (of a piezoelectric resonator)

The maximum permissible deviation of the working frequency of a piezoelectric resonator from its nominal frequency, for any cause.

561-02-16 adjustment tolerance (of a piezoelectric resonator)

The maximum permissible deviation of the working frequency of a piezoelectric resonator from its nominal frequency at the reference temperature under specified conditions.

561-02-17 frequency tolerance (due to ageing) (of a piezoelectric resonator)

The maximum permissible deviation of the working frequency of a piezoelectric resonator from its initial frequency which is observed with the passage of time under specified conditions.

561-02-18 frequency tolerance (over a temperature range) (of a piezoelectric resonator)

The maximum permissible deviation of the working frequency of a piezoelectric resonator within a specified temperature range from its working frequency at the reference temperature.

561-02-19 frequency tolerance (due to variations in level of drive) (of a piezoelectric resonator)

The maximum permissible deviation in the working frequency of a piezoelectric resonator resulting from specified variations in level of drive.

561-02-20 relative frequency spacing (symb. : B_s)

The ratio of the difference between the parallel resonance frequency f_p and the series resonance frequency f_s in a given mode of vibration, to the series resonance frequency:

$$B_s = \frac{f_p - f_s}{f_s}$$

561-02-21 operating temperature range (of a piezoelectric resonator)

Thr range of temperature as measured on the enclosure over which a piezoelectric resonator must function within the specified tolerances.

561-02-22 operable temperature range (of a piezoelectric resonator)

The range of temperature, as measured on the enclosure, over which a piezoelectric resonator must be capable of meeting the resistance requirements but not necessarily within the specified frequency tolerances.

561-C2-23 storage temperature range (of a piezoelectric resonator)

The range of temperature within which a piezoelectric resonator can be stored, without causing any permanent deviation of characteristics outside the specified tolerances.

561-02-24 reference temperature (of a piezoelectric resonator)

The temperature, as measured on the enclosure, at which certain measurements are made on a piezoelectric resonator.

561-02-25 resonance resistance (of a piezoelectric resonator) (symb. : R_r)

The equivalent resistance of a piezoelectric resonator alone at its resonance frequency f_r.

561-02-26 motional resistance (of a piezoelectric resonator) (symb. : R_1)

The resistance of the motional or series arm of the equivalent circuit.

561-02-27 level of drive (of a piezoelectric resonator)

A value of the amplitude of motion imposed on a piezoelectric resonator, usually expressed in terms of power dissipated.

561-02-28 unwanted resonance (of a piezoelectric resonator)

unwanted response (of a piezoelectric resonator)

A state of resonance of a piezoelectric resonator other than that associated with its working frequency.

561-02-29 load capacitance (of a piezoelectric resonator) (symb. : C_L)

The effective external capacitance which in combination with the piezoelectric resonator, determines the working frequency.

561-02-30 load resonance resistance (of a piezoelectric resonator) (symb. : R_L)

The equivalence resistance of a piezoelectric resonator in series with a stated load capacitance at the load resonance frequency f_L.

561-02-31 motional capacitance (of a piezoelectric resonator) (symb. : C_1)

The capacitance of the motional or series arm of the equivalent circuit.

561-02-32 motional inductance (of a piezoelectric resonator) (symb. : L_1)

The inductance of the motional or series arm of the equivalent circuit.

561-02-33 shunt capacitance (symb. : C_O)

The capacitance in parallel with the motional arm of the equivalent circuit.

561-02-34 free capacitance (of a piezoelectric ceramic resonator) (symb. : C_f)

The capacitance of a piezoelectric ceramic resonator measured at a frequency well below the lowest resonance frequency.

561-02-35 clamped capacitance (of a piezoelectric ceramic resonator)

The capacitance of a piezoelectric ceramic resonator measured at a frequency well above any pronounced resonance.

561-02-36 partially clamped capacitance (of a piezoelectric ceramic resonator)

The capacitance of a piezoelectric ceramic resonator measured at a frequency well above the main resonance frequency of the given family of vibration.

561-02-37 electromechanical coupling factor

The square root of the ratio of electrical or mechanical work which can be accomplished to the total energy that can be stored in a piezoelectric resonator from a mechanical or electrical power source for a particular sent of boundary conditions.

561-02-38 trapped energy mode

A mode of vibration in which the vibrating energy is mainly confined to a defined area of the vibrator.

561-02-39 symmetric frequency of a monolithic bipole vibrator

The lowest resonance frequency of a monolithic bipole vibrator whose output terminals are short-circuited.

561-02-40 antisymmetric frequency of a monolithic bipole vibrator

The highest resonance frequency of a monolithic bipole vibrator whose output terminals are short-circuited.

SECTION 561-03-PIEZOELECTRIC FILTERS

561-03-01 piezoelectric filter

An electrical filter in which one or more piezoelectric vibrators are incorporated.

561-03-02 input level

The power, voltage or current value presented to the input terminal pair of a piezoelectric filter.

561-03-03 output level

The power, voltage or current value delivered to the load circuit of a piezoelectric filter.

561-03-04 rated level

The power, voltage or current value at which the characteristics of a piezoelectric filter are specified.

561-03-05 maximum level

The power, voltage or current value above which unacceptable distortion of the signal or irreversible changes may occur in a piezoelectric filter.

561-03-06 available power

The maximum power which may be obtained from a given source by suitable adjustment of the load impedance.

561-03-07 input impedance

The impedance presented by a piezoelectric filter to the signal source when terminated in the specified load impedance.

561-03-08 output impedance

The impedance presented by a piezoelectric filter to the load when its input is connected to the specified source impedance.

561-03-09 terminating impedance

The impedance presented to a piezoelectric filter by its load or by its source.

561-03-10 cut-off frequency

A frequency of the pass band at which the relative attenuation of a piezoelectric filter reaches a specified value.

561-03-11 mid-band frequency (of a band-pass or band-stop filter)

The geometric mean of the cut-off frequencies limiting a single pass band or a single stop band.

Note. — In practice, the arithmetic mean is often used as a good approximation to the geometric mean for piezoelectric filters with relatively narrow pass bands or stop bands.

561-03-12 nominal frequency (of a piezoelectric filter)

The frequency used to identify the piezoelectric filter.

561-03-13 pass band

A band of frequencies in which the relative attenuation of a piezoelectric filter is equal to or less than a specified value.

561-03-14 pass bandwidth

The separation of frequencies between which the attenuation of a piezoelectric filter shall be equal to or less than a specified value.

561-03-15 stop band

A band of frequencies in which the relative attenuation of a piezoelectric filter is equal to or greater than specified values.

561-03-16 stop bandwidth

The separation of frequencies between which the relative attenuation of a piezoelectric filter shall be equal to or greater than a specified value.

561-03-17 transition band

a band of frequencies between a cut-off frequency and the nearest point of the adjacent stop band.

561-03-18 envelope delay time

The time of propagation of a certain characteristic of a signal envelope between two points, for a certain frequency.

561-03-19 phase delay time

The time of propagation of a sinusoidal oscillation of a certain frequency between two points.

561-03-20 transducer attenuation (of a filter)

The ratio, generally expressed in decibels, of the available power of a given source to the power that the filter connected to this source, delivers to a load impedance under specified conditions.

561-03-21 insertion attenuation (of a filter)

The ratio, generally expressed in decibels, of the power delivered to the load impedance before insertion of the filter to the power delivered to the load impedance after insertion of the filter.

561-03-22 transducer phase

The phase difference between the output of a given filter with a specified load impedance and the source connected to its input.

561-03-23 modulus of the reflection coefficient

A dimensionless measure of the degree of mismatch between two impedances Z_a and Z_b, given by the expression :

$$\left|\frac{Z_a - Z_b}{Z_a + Z_b}\right|$$

where:

Z_a = the source or output impedance
Z_b = the load or input impedance.

561-03-24 return attenuation

The reciprocal, generally expressed in decibels, of the modulus of the reflection coefficient.

561-03-25 relative attenuation

The difference between the attenuation at a given frequency and the minimum attenuation in the pass band.

561-03-26 shape factor (of a band-pass or band-stop filter)

The ratio of the two bandwidths of a band-pass or a band-stop filter limited by two specified attenuation values.

561-03-27 pass-band ripple (of a filter)

The maximum variation of the attenuation within a defined portion of the pass-band of a filter.

561-03-28 distortion of envelope delay time (in an electrical network)

An unwanted variation of the envelope delay time of a signal in an electrical network as a function of frequency.

561-03-29 phase distortion (in an electrical network)

An unwanted variation of phase difference in an electrical network as a function of frequency.

561-03-30 intermodulation distortion

The distortion resulting from the combination within the filter of two independent input signals.

561-03-31 low-pass filter

A filter having a single pass band below a cut-off frequency and a stop band for higher frequencies.

561-03-32 high-pass filter

A filter having a single pass band above a cut-off frequency and a stop band for lower frequencies.

561-03-33 band-pass filter

A filter having a single pass band between two specified stop bands.

561-03-34 band-stop filter

A filter having a single stop band between two specified pass bands.

561-03-35 comb filter

A two terminal pair filter in which there are five or more bands of which two or more are pass bands and two or more are stop bands.

561-03-36 monolithic filter

A filter with at least one monolithic multiple pole vibrator.

SECTION 561-04-PIEZOELECTRIC CRYSTAL CONTROLLED OSCILLATORS

561-04-01 simple packaged crystal oscillator

SPXO

A crystal controlled oscillator having no means of temperature control or compensation, exhibiting a frequency/temperature characteristic determined substantially by the piezoelectric resonator employed.

561-04-02 overtone controlled oscillator

An oscillator designed to operate with the controlling piezoelectric resonator functioning in a specified mechanical overtone order of vibration.

561-04-03 voltage controlled crystal oscillator

VCXO

A crystal controlled oscillator, the frequency of which can be deviated or modulated according to a specified relation, by application of a control voltage.

561-04-04 temperature compensated crystal oscillator

TCXO

A crystal controlled oscillator whose frequency deviation due to temperature is reduced by means of a compensation system, incorporated in the device.

561-04-05 oven controlled crystal oscillator

OCXO

A crystal controlled oscillator in which at least the piezoelectric resonator is temperature controlled.

561-04-06 nominal frequency (of a crystal controlled oscillator)

The frequency used to identify the crystal controlled oscillator.

561-04-07 frequency tolerance (of a crystal controlled oscillator)

The maximum permissible deviation of the oscillator frequency from a specified nominal value when operating under specified conditions.

561-04-08 frequency offset

The frequency difference, positive or negative, which should be added to the specified nominal frequency of the oscillator, when adjusting the oscillator frequency under a particular set of operating conditions in order to minimize its deviation from nominal frequency over the specified range of operating conditions.

561-04-09 adjustment frequency

The frequency to which an oscillator must be adjusted, under a particular combination of operating conditions, in order to meet the frequency tolerance specification over the specified range of operating conditions, i.e. adjustment frequency = nominal frequency + frequency offset.

561-04-10 frequency adjustment range

The range over which the oscillator frequency may be varied by means of some variable element, for the purpose of:

a) setting the frequency to a particular value, or
b) to correct the oscillator frequency to a prescribed value after deviation due to ageing, or other changed conditions.

561-04-11 operating temperature range (of a crystal controlled oscillator)

The range of temperature over which the oscillator will function, maintaining frequency and other output signal characteristics within specified tolerances.

561-04-12 operable temperature range (of a crystal controlled oscillator)

The range of temperature, over which the oscillator will continue to provide an output signal, though not necessarily within the specified tolerances of frequency, level, waveform etc.

561-04-13 stabilization time

The time, measured from the initial application of power, required for a crystal controlled oscillator to stabilize its operation within specified limits.

561-04-14 frequency/voltage coefficient

The fractional change in output frequency resulting from an incremental change in supply voltage, other parameters remaining unchanged.

561-04-15 frequency/load coefficient

The fractional change in output frequency resulting from an incremental change in electrical load impedance, other parameters remaining unchanged.

561-04-16 short-term frequency stability

The random fluctuations of the frequency of an oscillator over short periods of time.

561-04-17 power spectral density of fractional frequency deviations

The r.m.s. value of the random fluctuations of the frequency.

Note. — This quantity is the preferred frequency domain measure of short term stability.

561-04-18 Allan variance two-sample variance

A measure of random frequency fluctuations from the mean frequency of an oscillator in the time domain.

Note. — The variance is calculated from a series of consecutive data, with no dead time, using two samples at a time.

SECTION 561-05-SYNTHETIC QUARTZ CRYSTAL

561-05-01 synthetic quartz crystal

A single crystal of alpha quartz grown by the hydrothermal method.

Note. — The crystal is of either handedness and in the "as grown" condition.

561-05-02 synthetic quartz crystal batch

Synthetic quartz crystals grown at the same time in one autoclave.

561-05-03 seed (of quartz)

The quartz plate or bar used as a nucleus for synthetic quartz crystal growth.

561-05-04 growth zone

The region of a synthetic quartz crystal resulting from growth along a specific crystallographic direction.

561-05-05 orientation of a synthetic quartz crystal

The orientation of the seed of a synthetic quartz crystal with respect to the crystallographic axis system.

561-05-06 inclusion

Any foreign material within a synthetic quartz crystal made visible when examined by light from a bright source.

Note. — A particularly common inclusion is the mineral acmite (sodium iron silicate).

561-05-07 seed veil

The array of inclusions or voids at the surface of the seed upon which a crystal has been grown.

561-05-08 dopant

An additive used in the growth process which may change the chemical composition and affect the physical or electrical properties of the synthetic quartz batch.

561-05-09 dislocation

A geometrical defect in the normal lattice arrangement of atoms in a crystalline medium.

561-05-10 pre-dimensioned bar lumbered synthetic quartz crystal

Any bar of synthetic quartz crystal whose "as grown" dimensions have been altered by sawing, grinding, lapping, etc., to meet a particular dimensional requirement.

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